STATE OF WASHINGTON

ESTIMATE FOR
DEVELOPMENT OF A TRAILS AND FACILITIES DATABASE

Prepared for
Interagency Committee on Outdoor Recreation (IAC)

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SECTION 1

EXECUTIVE SUMMARY

1.1   PURPOSE

The purpose of this report is to provide an estimate of the costs necessary to:

1. Develop a Geographic Information System (GIS) database of motorized and non-motorized trails throughout the State of Washington.

2. Develop an application which will allow the public to download data from the trails database in a format that is useable in consumer Global Positioning System (GPS) devices and will aid in navigating recreational trails throughout the State of Washington.

3. Develop a web-based portal to allow the public to link to existing trails information on the Internet such as the Department of Natural Resources (DNR) recreation maps and Forest Service recreation maps.

1.2   PARTICIPANTS

This report was prepared for the Washington State Interagency Committee on Outdoor Recreation (IAC). Weston Solutions, Inc. (WESTON) conducted interviews with numerous state and federal agencies that manage recreational trail-related data throughout the State. Agencies interviewed include:

- IAC
- Washington State Parks
- Department of Natural Resources
- US Forest Service
- National Park Service
- Bureau of Land Management
- US Army Corps of Engineers

1.3   METHODS

A GIS is a powerful tool that allows large amounts of information to be linked to a geographic location. For the trails and facilities database, descriptive attributes about the trails, such as trail width, surface type, managed use, etc. will be included in the GIS database. There is currently no single standard for the structure of geographic trails data or associated attributes. While some existing GIS-based trail data are currently available from various state, federal, county, and

municipal agencies throughout the State of Washington, these data exist in various formats, with different combinations of attribute information, and with varying degrees of spatial and attribute accuracy. The scope of this investigation focused on state and federal agencies as sources for data. Additionally, very few of the datasets that are available in a GIS format contain the attribute information needed to be useful in a statewide recreational trails database. Appendix B provides details on available sources for trails data. Trail information is available from private sources, but proprietary concerns combined with the fact that much of the private information repeats public agency information resulted in the judgment that pursuing these sources was counter productive at this time.

A conceptual design of a GIS database is presented in Appendix C, and cost and schedule estimates in Appendix D have been developed to guide system development.

1.4   COST ESTIMATE

Table 1-1 summarizes the cost estimates for each of the three elements addressed by the study. The largest costs reflect lack of data for trails on state owned land. Also, the cost estimate ranges from low to high, to reflect the reality that not all future contingencies can be accounted for.

Table 1-1—Estimated Implementation Costs

Cost Category	Low	High
1. Develop GIS Trails Database with Web Access & GPS Download		
Database Design	$43,000	$43,000
Source Data Provision & Coordination	$231,650	$231,650

Trails Database Collection
    State Lands
    Federal Lands
	
	$882,020
	$369,200
		
		$1,235,630
		$543,800

Data Translation	$20,000	$20,000
Web Access	$95,000	$145,000
2. GPS Data Download Functionality	$72,000	$87,000
Subtotal	**$1,712,870**	**$2,306,080**
3. Develop Web Portal	**$19,000**	**$29,000**
TOTAL	**$1,731,870**	**$2,335,080**

Note: Estimating ongoing maintenance costs is beyond the scope of this investigation. However, IAC previously provided a rough estimate of $73,900 per year from 2007 through 2011 (managing agency could require $25,000 per year and DNR could require $48,900 per year).

1.5   SCHEDULE

Development of the trails database, web access interface, and GPS data download tools should be scheduled over a 2 year period. Development of the Web Portal may be scheduled concurrently. However, if the state elects to develop the Web Portal independent of the trails database, it could require approximately 3-6 months to develop.

Section 2

SECTION 2

FINDINGS

2.1 PURPOSE

The purpose of this report is to provide an estimate of the costs necessary to:

1. Develop a Geographic Information System (GIS) database of motorized and non-motorized trails throughout the State of Washington.

2. Develop an application which will allow the public to download data from the trails database in a format that is useable in consumer Global Positioning System (GPS) devices and will aid in navigating recreational trails throughout the State of Washington.

3. Develop a web-based portal to allow the public to link to existing trails information via the Internet using sources like the Department of Natural Resources (DNR) recreation maps and Forest Service recreation maps.

These estimates have been prepared in response to Engrossed Substitute Senate Bill (ESSB) 6384 which directs the Washington Interagency Committee on Outdoor Recreation (IAC) to "...prepare cost estimates for creating a database of motorized and nonmotorized off-road trails and facilities in Washington state. The cost estimate shall consider the possibility of a database that allows the downloading of maps formatted for the most widely used GPS devices, including the feasibility and cost to make GPS maps readily available for all users of Washington recreational lands and facilities. For this purpose, available GPS maps shall include GPS maps developed by state agencies, by federal agencies, and proprietary maps offered by private companies." Section 170 (1).

2.2 PARTICIPANTS

This report was prepared for the Washington State Interagency Committee on Outdoor Recreation (IAC). Weston Solutions, Inc. (WESTON) conducted interviews with numerous state and federal agencies that manage recreational trail-related data throughout the State (see Appendix A). WESTON researched relevant data sources, data systems, provided the analysis, and prepared this report. Agencies interviewed include:

- IAC
- Washington State Parks
- Department of Natural Resources
- US Forest Service
- National Park Service
- Bureau of Land Management

- US Army Corps of Engineers

2.3 METHODS

A GIS is a powerful tool that allows large amounts of information to be linked to a geographic location. For the trails and facilities database, descriptive attributes about the trails, such as trail width, surface type, managed use, etc. will be included in the GIS database. There is currently no single standard for the structure of geographic trails data or associated attributes. While some existing GIS-based trail data are currently available from various state, federal, county, and municipal agencies throughout the State of Washington, these data exist in various formats, with different combinations of attribute information, and with varying degrees of spatial and attribute accuracy.

The scope of this investigation focused on state and federal agencies as sources for data. Additionally, very few of the datasets that are available in a GIS format contain the attribute information needed to be useful in a statewide recreational trails database. Appendix B provides details on available sources for trails data. Trail information is available from private sources, but proprietary concerns combined with the fact that much of the private information repeats public agency information resulted in the judgment that pursuing these sources was counter productive at this time.

2.4 CONCEPTUAL DESIGN

This section provides a summary of the conceptual designs for the cost estimate items included in this report: 1) Trails database with web access and 2) GPS data download functionality, and 3) web-based portal to existing trails information. The trails database with web access is distinguished from the web-based portal in that the former includes development and population of a GIS database of recreational trails and related facilities and a web-based interface through which the user can access and interact with the database. The latter is a web portal that provides links to other sources of recreational trail information such as commercial data providers, and various federal, state and local government agencies and any other source that IAC chooses to include. See Appendix C for the detailed conceptual design. Note that the scope of work defined by IAC did not include estimates for operating and maintenance costs. Therefore, these conceptual designs are developed to the extent necessary for estimating capital costs.

2.4.1 Trails Database and Web Access

The trails database will contain a two-dimensional data model consisting of points, lines, and polygons in following feature data sets:

- Trails
- Boundaries
- Elevation – should be a single source; contours with elevation value as attribute
- Roads (line features with labels)

- Water features – should be a single source with feature labels
- Imagery

The conceptual design for the system includes tools that will provide web access to the trails database. These tools are defined in terms of the "trail user" experience. In a typical trail user scenario, the user links to the system's website through the IAC website or any participating agency's website.

Once logged in to the trails mapping web site, users will have the ability to:

- View an interactive trail map by panning and zooming on the map and/or by selecting a geographic area of interest, organized to allow rapid identification by the user.
- View trail attributes such as trail number, trail name, or allowable use/season of use
- View key trail and trailhead attributes by hovering the cursor over the feature. The attributes that would be displayed include:
  - Trail number
  - Trail name
  - Allowable use/season of use
- View limited metadata (descriptive information about the data) concerning all layers, including:
  - Data sources
  - Positional accuracy
  - Year of compilation
  - Date of last update
- Print the map that is being displayed by using the native web browser print functionality.

2.4.2 GPS Data Download Functionality

After viewing and identifying a trail of interest, as described in Section 2.4.1 above, the user selects a trail or multiple trails for download. Selection tools would allow the user to:

- Select one or more trails by number or name
- Select one or more trail segments using feature pointing
- Select all trails within a user-defined rectangle

Users could download limited amounts of data from the website. Downloads would be limited to 1 MB in order to minimize their impact on site performance. Users would be limited to 3 downloads per session to prevent data mining applications from impacting the site's performance.

The conceptual design for this estimated cost item assumes that there is no capability provided for downloading reference map data. It assumes that only GPS data may be downloaded.

2.4.3 Web-Based Portal

A web-based trails information portal would be designed to provide links to existing trail information available on the Internet. Development of the trails portal is independent of the trails database and web access defined in 2.4.1 above. It is a separate and much simpler web site. The portal will be accessed through a link on IACs main web page, as well as through a link on web pages of other government agencies. The sources of trail and facility information may include links to web resources for parks, campgrounds, published maps, state and federal agency trails data in GIS or descriptive format, and any public or private web sites the administrator has chosen to include.

Other organizations have used the portal concept to consolidate links to similar information. The State of Oregon Parks and Recreation Department, for example, maintains a web page (http://www.oregon.gov/OPRD/ATV/index.shtml) that provides access to information about their all terrain vehicle (ATV) program. This site presents information places to ride ATVs, opportunities for safety training, and links to other related web sites. American Trails, a non-profit organization promoting trail interests, maintains a web site (http://www.americantrails.org) that provides extensive information about trails nation wide. This site allows the user to search for trails and related information by state. South Carolina's State Trails Program has developed a trails portal site (http://sctrails.net/trails/) that provides extensive information about trails in that state, and links to an extensive list of government and non-government trail resources.

2.5 SCHEDULE AND COST ESTIMATES

This section provides a summary cost and schedule estimates to support the State's capital funding process. See Appendix D for detailed cost and schedule estimates. The estimates assume that services are contracted to the extent possible. Agency costs are estimated where staff effort is required, using an assumed total (burdened) hourly rate of $100.

The cost and assumptions for each of the three major cost items are provided below.

2.5.1 Trails Database and Web Access

Database Design and Conversion Specifications - $43,000

It is assumed that the agencies that will manage and update the trails data will participate in the database design process at a cost of 40 staff hours per agency. It is also assumed that the design effort is constrained to the scope defined by the conceptual database design presented in Appendix C. Costs to extend the design to address agency-specific data needs are not included in this estimate. See table D-2.

It is assumed that state agency staff would administer the database design and data conversion specification efforts. The technical labor for the database design and conversion specification efforts will be contracted.

Source Data Provision and Coordination - $726,650

As described in section 2.3 above, the amount of GIS data currently available for inclusion in a GIS-based trails and facilities database is extremely limited. Significant staff effort will be required of participating agencies to provide initial source data from which the trails database will be populated. Data will be sourced from the various databases and information in which each agency stores and manages the data for its current use.

Once data have been sourced and extracted, they must undergo quality assurance procedures to ensure their fitness for use in the statewide trails database. Data will then be compiled under contract, and edited prior to finalizing the database. See Table D-3.

Data Collection / Compilation / Quality Assurance - $1,231,220 – 1,759,430

Based on information included in Appendix B on the availability of existing trails data, Table D-4 was compiled to estimate the cost of additional data collection, compilation, and quality assurance. Construction costs per mile vary, depending on the use of domestic or off-shore labor for the compilation component. See Table D-4.

Significant trails data exist for the U.S. Forest Service lands, including features and attributes. It is assumed that there is no additional cost for data collection, compilation, or quality assurance.

Trail feature data exist for the National Park Service lands but attribute data must be compiled. Therefore, trail features must be attributed.

Washington DNR maintains an estimated 1,100 miles of designated trails, comprised of a combination of use designations. Approximately ten percent of these trails are mapped.

Washington State Parks has mapped trails only on a pilot basis. It is assumed that all state park trails need to be mapped and attributed.

Data Translation - $20,000

It is assumed that a data translation utility must be developed to import trails data managed by the U.S. Forest Service.

Web Access - $95,000 - $145,000

Costs for web access application development are based on an estimate of 100 function points. Function points are a measure of the size of computer applications and the projects that build them. The size is measured from a functional, or user, point of view. It is independent of the computer language, development methodology, technology or capability of the project team used to develop the application.

Costs per function point range from $750 to $1,250. The contracted application development cost is $75,000 to $125,000. The cost of contract administration, quality assurance, and transition is 200 hours of staff time at $100 per hour, or $20,000.

2.5.2 Web Portal - $19,000 - $29,000

Costs for web portal development are based on an estimate of 20 function points. The contracted application development cost is $15,000 to $25,000. The cost of contract administration, quality assurance, and transition is 40 hours of staff time at $100 per hour, or $4,000.
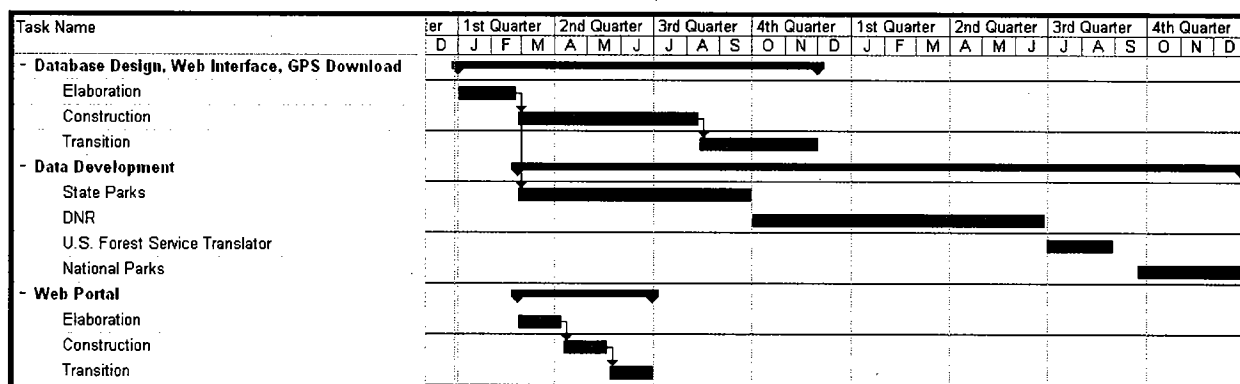
2.5.3 GPS Data Download Functionality - $72,000 - $87,000

Costs for development of a GPS data download application is based on an estimate of 60 function points. The contracted application development cost is $60,000 to $75,000. The cost of contract administration, quality assurance, and transition is 120 hours of staff time at $100 per hour, or $12,000.

2.5.4 Schedule

This entire project should be scheduled for two years. See Appendix D, Figure D-1 for a recommended schedule for implementing the trails database with web access and optional GPS data download functionality. Application development should start immediately upon project authorization. Data conversion should start after database design is completed (at the end of elaboration). The application construction schedule will vary by up to two months, depending on whether the GPS data download functionality is included. The site should launch with State Parks data. DNR, U.S. Forest Service, and National Parks data should be added in whole management units as they are completed.

Figure 2-1—Schedule for Trails Database & Web Portal

Task Name	ier	1st Quarter		2nd Quarter			3rd Quarter			4th Quarter			1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
- Database Design, Web Interface, GPS Download																									
Elaboration																									
Construction																									
Transition																									
- Data Development																									
State Parks																									
DNR																									
U.S. Forest Service Translator																									
National Parks																									
- Web Portal																									
Elaboration																									
Construction																									
Transition																									

The web portal development should be scheduled for three months, including transition.

2.6 RISKS

The following are major risks that must be managed:

- **Availability of data** – this investigation has revealed that there is relatively little GIS trails data available for a statewide recreational trails database. In most cases, data that are available will require addition and editing of data attribute data to meet the project's needs.

- **Ongoing maintenance resources** – evaluating staffing levels and cost for ongoing maintenance of the trails database and related systems are beyond the scope of this study. Ongoing maintenance costs must be understood and accepted in order to ensure ongoing support. Failure to adequately fund ongoing maintenance and enhancements to the site will limit its usefulness and place the initial capital investment at risk.

- **Design consensus** – Each participating agency will have differing interests and priorities concerning system design. Balancing these interests and priorities to achieve consensus will be critical to the long-term success of the system.

- **Use and misuse of data** – the data manager must consider the liability involved in providing trails and facilities data to the public. Users may potentially use or misuse data in a manner that may lead to situations that cause harm to themselves or others. The data manager should develop and users should agree to terms of use before accessing and using trails data and systems.

Appendix A

APPENDIX A

INTERVIEWEES

Braaten, Anne, GIS Analyst, North Cascades National Park Service Complex, Sedro-Woolley, WA

Benge, Phil, Natural Resource Specialist, US Army Corps of Engineers, Walla Walla District, Walla Walla, WA

Dalby, Craig, GIS Program Manager, National Park Service, Seattle, WA

DePuydt, Ray, Archaeologist, Lake Roosevelt National Recreation Area, Kettle Falls, WA

Frayer, Chuck, Recreation Data Specialist, United States Forest Service, Region 6, Portland, OR

Hillis, Cathy, System Administrator, Bureau of Land Management (Northrop Grumman), Wenatchee Resource Area Office, Wenatchee, WA

Hoffman, Roger, GIS Specialist, Olympic National Park, Port Angeles, WA

Nagygyor, Alex, Forest Engineer, Washington Department of Natural Resources, Olympia, WA

Perkins, Diane, Planner, Washington Department of Natural Resources, Olympia, WA

Rockwell, Craig "Rocky", Assistant Natural Resource Manager, US Army Corps of Engineers, Clarkston, WA

Scott, Kathryn, GIS Coordinator, Washington State Parks, Olympia, WA

Silcox, Vicky, Natural Resource Management Team Lead, US Army Corps of Engineers, Seattle District, Seattle, WA

Silva-Perry, Ralph, Cartography Supervisor, Washington Department of Natural Resources, Olympia, WA

Stevens, Heidi, Natural Resource Technician III, Washington Department of Natural Resources, Olympia, WA

Swinney, Darin, GIS Specialist, Mt Rainier National Park, Ashford, WA

Wing, Michael, Assistant Professor of GIS and Spatial Analysis, Oregon State University, Corvallis, OR

Wolf, Margaret, Bureau of Land Management, Oregon State Office, Portland, OR

Appendix B

Appendix B

EXISTING DATA RESOURCES

The following agencies were interviewed to determine to determine the extent of existing trails inventory data available:

- National Park Service
- U.S. Forest Service
- Washington State Parks
- Department of Natural Resources
- Bureau of Land Management
- Army Corps of Engineers

Many potential data sources were cursorily examined, but most of the sources are fragmented and incomplete. The most promising data resources have been catalogued and summarized below. Significant data resources for inclusion are defined in terms of the following attributes:

- Brief data description
- Existing data custodians
- Data format
- Rough estimate of completeness
- Rough estimate of spatial coverage
- Rough estimate of currency
- Rough estimate of accuracy (spatial and attribute)
- Rough estimate of data amount

In summary, the State of Washington does not have significant current trail data resources. The U.S. Forest Service has a formal trails inventory and database format. The U.S. Park Service has trails geometry but it is not stored in a database format that lends itself to data sharing with the State.

NATIONAL PARK SERVICE

Description
Mt. Rainier National Park – Trails Data Layer
Data Format
ArcSDE
Custodian
National Park Service, Mount Rainier National Park
General Contents

Mount Rainier National Park designated trails and social trails. Contains limited descriptive attribute information. Includes attributes for Trail Name, Type, Subtype, National Historic Landmark Status, and Source.

Spatial Coverage

Mount Rainier National Park

Purpose

Developed to support park planning and to prepare recreational maps for park visitors.

Completeness

Contains all trails within the park.

Currency

Current. Updated annually and when new data are made available through studies and other activities.

Accuracy (spatial and attribute)

Sub-alpine trails accurate to within 40 feet. They were initially derived from USGS 7.5' quadrangles, and improved as GPS data have been collected or trails are adjusted to aerial photos in conjunction with park planning and maintenance activities. Forested trails are of questionable spatial accuracy. Attributes are complete and reported to be reliable.

Size of Data Set

390 trail segments, approximately 295 trail miles (includes some social trails).

Description	
	North Cascades National Park Service Complex – Trails Data Layer
Data Format	
	Shapefile
Custodian	
	National Park Service – North Cascades National Park Service Complex
General Contents	
	North Cascades Complex designated trails. Contains limited descriptive attribute information. Includes attributes for Trail Name, Source, Owner, Confidence Level, Type, User Type (climber, hiker, stock), and a comment field that contains information about source and accuracy.
Spatial Coverage	
	North Cascades National Park, Ross Lake, and Lake Chelan National Recreation Areas.
Purpose	
	Developed primarily to prepare maps for internal purposes and recreational maps and publications for park visitors.
Completeness	
	Contains all designated trails within the park complex.
Currency	
	Believed to be current.
Accuracy (spatial and attribute)	
	They were initially digitized from USGS 7.5' quadrangles. In late 1990's, trails visible on digital orthophotos were adjusted to the aerial photos. Visible trails are believed to be accurate within 3 – 20 feet (1 – 6 meters). Forested trails are of questionable spatial accuracy and believed to be no better that the USGS best guess of +- 40 feet.
Size of Data Set	
	660 trail segments, approximately 592 trail miles.

Description	
Olympic National Park – Trails Data Layer	
Data Format	
Coverage	
Custodian	
National Park Service – Olympic National Park	
General Contents	
Olympic National Park designated trails. Contains limited descriptive attribute information. Includes attributes for Trail Name, Source, Owner, Confidence Level, Type, User Type (climber, hiker, stock), and a comment field that contains information about source and accuracy.	
Spatial Coverage	
North Cascades National Park, Ross Lake, and Lake Chelan National Recreation Areas.	
Purpose	
Developed primarily to prepare maps for internal purposes and recreational maps and publications for park visitors.	
Completeness	
Contains all designated trails within the park complex.	
Currency	
Believed to be current.	
Accuracy (spatial and attribute)	
Initially digitized from USGS 7.5' quadrangles. In late 1990's, trails visible on digital orthophotos were adjusted to the aerial photos. Visible trails are believed to be accurate within 3 – 20 feet (1 – 6 meters). Forested trails are of questionable spatial accuracy and believed to be no better that the USGS best guess of +- 40 feet.	
Size of Data Set	
660 trail segments, approximately 592 trail miles.	

Description
Small National Parks – Trails Data Layers
Data Format
Shapefiles
Custodian
National Park Service – Region 6
General Contents
Trails data for smaller parks, including: • San Juan Island • Ebey's Landing • Lake Roosevelt National Recreation Area
Spatial Coverage
Individual parks
Purpose
Simple cartographic products.
Completeness
There are no attributes or classification scheme, just features
Currency
Unknown
Accuracy (spatial and attribute)
Unknown
Size of Data Set
Not specified

US FOREST SERVICE

Description
US Forest Service/US Department of Agriculture – INFRA Database
Data Format
Oracle Database
Custodian
US Forest Service/US Department of Agriculture - Forest level or even at District level within forest.
General Contents
OMB's new mandated database standard for operational and maintenance data.

APLEX data (Legacy data structure for trails data. Flat file systems ("like Excel"). Contains coordinate data) has been migrated but Forest Service is still cleaning up data that did not map across cleanly.

Some discussion of mapping the trails. Uncertain of approach; Maybe go from GPS tracks. Some forests have done some GPS data collection.

USDA took over INFRA database nine months ago and moved into their responsibility and formatting for IWEB user interface. Forest Service now cleaning up USDA database. Should be completed in late 2007.

Trail design classes:
- 1 – wilderness
- 2 – Semi-wilderness
- 3 – 18" minimum width, may be surfaced in wet areas, drainage system
- 4 – 36" wide for ATV access
- 5 - 18" minimum width, crushed rock, maybe wheelchair accessible

Spatial Coverage

National

Purpose

Completeness

Completeness of data is 100% of facilities. Coordinate data is spotty though. Confidence in data quality is low. It should increase dramatically in one year, with clean-up effort. Trailheads are cleaned up already.

Currency

No standards or guidance for frequency of update.

Accuracy (spatial and attribute)

Spatial accuracy – N/A. Attribute accuracy is currently being improved through data consolidation and clean up.

Size of Data Set

Not specified

WASHINGTON STATE PARKS

Description

Washington State Parks and Recreation Commission – Trails Database Pilot Data

Data Format

Shapefile
Custodian
Washington State Parks and Recreation Commission
General Contents

Just starting to explore trail database design and data collection. Is in process of a pilot project with about 12 trails. Shape file format. No forecast at this time for building the data set. No funding. Attributes include:
• Surface
• Difficulty
• Width
• Shoulder
• Seasons
• Dogs allowed
• Purpose:
    - Dog sled
    - X-C skiing
    - Snowshoe
    - Hike
    - Mt. bike
    - Road bike

Spatial Coverage
Pilot area – limited spatial coverage.
Purpose
Proof of concept for development of trails database.
Completeness
Data currently being developed.
Currency
Data currently being developed.
Accuracy (spatial and attribute)
No spatial QA; not registered to aerial photo imagery.
Size of Data Set
Not specified

Description
Washington State Parks and Recreation Commission – Trails of Statewide Significance

Data Format
Shapefile

Custodian
Washington State Parks and Recreation Commission

General Contents
Rails to trails. More detailed inventory with infrastructure detail. Different details than are envisioned for trails in State Parks. Will migrate to personal geodatabase. Includes 54 trailheads (there are many more trailheads that have not been included).

Spatial Coverage
Statewide

Purpose
Not specified

Completeness
Unknown – Data not provided for evaluation

Currency
Not specified

Accuracy (spatial and attribute)
Unknown – Data not provided for evaluation

Size of Data Set
Unknown – Data not provided for evaluation

Description
Washington State Parks and Recreation Commission – Snowmobile Trails/Winter Recreation
Data Format
Shapefile
Custodian
Washington State Parks and Recreation Commission
General Contents
Covers snowmobile trails on Forest Service lands. Uses: • Snowmobile • Dog sled • Snow shoe
Spatial Coverage
Statewide
Purpose
Mapping and identification
Completeness
Unknown – Data not provided for evaluation
Currency
Updated annually, after uses for year set by grooming.
Accuracy (spatial and attribute)
Unknown – Data not provided for evaluation
Size of Data Set
Unknown – Data not provided for evaluation

Description
Washington State Parks and Recreation Commission – Snowmobile Trails/Winter Recreation
Data Format
Shapefile
Custodian
Washington State Parks and Recreation Commission
General Contents
Covers snowmobile trails on Forest Service lands. Uses: • Snowmobile • Dog sled • Snow shoe
Spatial Coverage
Statewide
Purpose
Mapping and identification
Completeness
Unknown – Data not provided for evaluation
Currency
Updated annually, after uses for year set by grooming.
Accuracy (spatial and attribute)
Unknown – Data not provided for evaluation
Size of Data Set
Unknown – Data not provided for evaluation

DEPARTMENT OF NATURAL RESOURCES

Description
DNRTrans – Washington Department of Natural Resources
Data Format
Coverage
Custodian
Washington DNR
General Contents
Transportation data layer. Includes some forest roads along with state and

interstate roads/highways. Contains some Forest Service and less than 10% of DNR trails. Includes classification system for route types: Road, Railroad, Railroad Grade, Ferry Crossing, Trail, and Unspecified Transportation Route. Amongst others, also includes classifications for surface types, and road status (active or abandoned). The database contains no allowable-use attribute.

Spatial Coverage

Statewide

Purpose

Mapping and miscellaneous analysis.

Completeness

On DNR lands, completeness is estimated at 95%.

Currency

There has been no uniform data collection & maintenance method. On DNR land, edited roads are current as of 2005. Much of the other data may be out of date.

Accuracy (spatial and attribute)

On DNR lands, spatial accuracy +/- 40 feet. Approximately 5% are outside of this accuracy level. Outside of DNR lands, accuracy and consistency are questionable. Spatial accuracy is thought to be +/- 500 feet.

Size of Data Set

Approximately 12,000 miles of roads maintained by DNR.   Less than 10% of the approximately 1,100 miles of DNR designated trails are represented.

Description	
DNR State Forest Maps	
Data Format	
Coverages	
Custodian	
Washington DNR	
General Contents	
Cartographic products have been developed for heavily used areas over the past 16 years. These maps use various road and trail classification schemes.	
Spatial Coverage	
Various areas with complete block plan.	
Purpose	
For production of various large and small format cartographic products.	
Completeness	
Various areas with complete block plan.	
Currency	
Currency varies.	
Accuracy (spatial and attribute)	
Spatial accuracy +/- 40 feet.	
Size of Data Set	

Description	
	DNR Quad Maps
Data Format	
	Hard copy maps
Custodian	
	Washington DNR
General Contents	
	1:100,000 scale DNR map series (49 maps) that follows USGS standards. Information on Forest Service land. Some city and county data. Also tribal, BLM, and State Parks. Data collected from Forest Service maps and re-compiled in GIS for DNR publications. Shows public land ownership by agency. Roads include features that cartographers can update on orthophotos verified with owner/agency.
Spatial Coverage	
	Statewide
Purpose	
	For production of various large and small format cartographic products.
Completeness	
	Inconsistent completeness due to density of features at compilation scale.
Currency	
	Roads and trails updated on this series every 4-10 years, depending on popularity of the map sheet.
Accuracy (spatial and attribute)	
	Spatial accuracy +/- 40 feet.
Size of Data Set	

BUREAU OF LAND MANAGEMENT

Description	
	Ground Transportation Trails Publication Arc
Data Format	
	Coverage
Custodian	
	BLM – Oregon State office supported by district offices

General Contents
Spatial Coverage
Statewide
Purpose
Created by BLM to support various GIS mapping spatial analysis needs.
Completeness
Covers mostly BLM-managed lands with some private lands included.
Currency
Continually maintained.
Accuracy (spatial and attribute)
Spatial accuracy believed to be +/- 40 feet. Attribute accuracy: the coverage contains many unpopulated attribute fields, including trail use, surface condition, average width, maintenance responsibility, maintenance level.
Size of Data Set
Total of 3,766 miles of roads, of which 1,190 miles are identified as "trails".

Appendix C

APPENDIX C

CONCEPTUAL DESIGN

This appendix defines the conceptual designs for the three cost estimate items: 1) Trails database with web access; 2) GPS-download functionality; and 3) web-based portal. These conceptual designs are developed to the extent necessary for estimating capital costs. Note that the scope of work defined by IAC did not include estimates for operating and maintenance costs.

TRAILS DATABASE AND WEB ACCESS

The conceptual design for this cost estimate item is divided into two parts: 1) Database; and 2) web Access to data stored within the trails database.

Database

The proposed database is to be based on a geographic information system (GIS). Map layers are an intuitive way of thinking about physical features represented in a GIS and the descriptive data related to them. This is a useful conceptual model for thinking about map-related data.

The generic feature data sets required in the trails database are:

- Trails
- Boundaries
- Elevation
- Roads
- Water
- Imagery

Key Assumptions

1. Trails data need to be compiled specifically for the trails database. The other layers are needed for reference, in order to display trails meaningfully for web access. Reference data already exist at large enough map scales to support display of trails for recreational navigation. Therefore, cost estimates are restricted to the compilation costs for the trails data plus the cost to load the reference layers into a GIS database on a one-time basis.

2. Trails data will have to be collected, compiled, and loaded for Washington State Parks and most Department of Natural Resources trails. The U.S. Forest Service will complete its trail database by 2008 in a format that will support data import into a statewide trails database. The National Park Service trails and trail-head data need to be attributed in order to support a statewide trails database. Trails data collected and compiled through a state-wide trails

database construction effort would be uniform in data structure across agencies but would not necessarily adopt the structure of the existing U.S. Forest Service trails data.

3. The structure for trails data collected and compiled through a state-wide trails database construction effort would contain the following types of data:

    a. Trail number

    b. Trail name

    c. Allowable use/season of use

    d. Trail owner/manager (populated through feature-in-polygon geoprocessing)

    e. Land use designation (populated through feature-in-polygon geoprocessing)

4. The spatial accuracy of trails data should be compatible with the positioning accuracy of recreational GPS devices. This implies +/-10 meters. Data of this accuracy will be suitable for display on maps as detailed as those compiled at 1:24,000.

5. The cost for database design effort and collection/compilation costs to incorporate additional trail attributes of interest to individual agencies is not considered within this study.

6. The trails database will be stored in an ESRI Geodatabase, managed by ArcSDE.

7. Once collected and compiled, trails data will be maintained by participating "owner" agencies.

8. Participating agencies may add segmentation, attribution (grade, material, width, etc.), and additional feature classes but will support a data structure that allows them to aggregate, translate, and export the standard data structure for updating the statewide trails database.

9. Updated trails data will be provided periodically by participating agencies to IAC for loading into the statewide trails database. (At the direction of IAC, this conceptual design does not extend to a design for automating any aspect of the update or quality assurance processes.

Design

The trails database will contain a two-dimensional data model consisting of points, lines, and polygons in following feature data sets in an ArcSDE database:

- Trails

    - Trail (line feature)

    - Trailhead (point feature, coincident with trail segment end)

- Boundaries

    - State of Washington (complex polygon feature)

    - State and federal agency management units (complex polygon features)

        o National Parks

   o State Parks

   o DNR

   o US Forest Service

   o BLM

   o ACOE

- Elevation – should be a single source; contours with elevation value as attribute

- Roads (line features with labels)
  - State and Interstate highways
  - Local roads within proximity of state and federal lands
  - State roads within state lands
  - Federal roads within federal lands

- Water features – should be a single source with feature labels
  - Rivers/streams (line feature)
  - Water bodies (polygon feature)

Trails will be physically segmented for attribute changes and junctions. Segment connectivity will be enforced. Attributes that define trail segmentation will be limited to those listed in assumption #4, above.

The trail database will include feature layer metadata in compliance with the Federal Geographic Data Committee specifications.

Web Access

Web access to the trails database provides the public with the ability to view trails information in a map presentation format. IAC has interpreted the scope of this study to exclude the following functionality from the web access: map layout, map download (see estimated cost item for GPS data download functionality), map upload by participating agencies, and automated map quality assurance/posting administration.

It is assumed that web access to the trails database will be hosted by a state agency and that there is no marginal hardware or GIS software cost.

The conceptual design for the web access to the trails database is defined in terms of the public's user experience. In a typical public user scenario, the user links to the system's website through the state agency website or any participating agency's website.

Disclaimer

The user accepts the conditions for the use of the system after reading and agreeing to a disclaimer statement. The disclaimer informs potential users that the data manager does not warrant the completeness or accuracy of the data presented by the site for any particular use and is not responsible for any consequences of its use. Once the user actively accepts the disclaimer, they are presented with the map interface.

View Trails

Users view an interactive trail map in a web map interface. The system is intuitive and user-friendly. Users are presented with a default map view in which a standard set of layers is displayed. The map display shows appropriate features and labels, depending on the map scale. The initial display is a state-wide map with state and federal lands highlighted thematically. The system determines the appropriate display scale given the extent of the selected features, only shows the references features that are appropriate for the selected display scale, and provides a standard legend.

Users may select a specific area to view through one of two methods:

- Map navigation – allows panning and zooming
- Geographic selection tool – provides a combination selection tool that displays all geographic areas of interest, organized to allow rapid identification by the user:
  - State parks
  - State DNR lands
  - National parks
  - National forests

Once the user is zoomed in to a scale of sufficient detail to support display of individual trails, the user may select allowable use/season of use.

View Feature Attributes

Users may view key trail and trailhead attributes by hovering the cursor over the feature. The attributes that are displayed are:

- Trail number
- Trail name
- Allowable use/season of use

View Metadata

Users may view very limited metadata concerning all layers. The metadata display is simple and covers the following:

- Sources

- Positional accuracy

- Year of compilation

- Date of last update

Print

Users may print the map that is being displayed by using the native web browser print functionality.

GPS DATA DOWNLOAD FUNCTIONALITY

The GPS data download functionality is dependent on the existence of the trails database and web access estimated cost item. GPS data download is most practically delivered as an expansion of the web access functionality.

There is no universal format for maps that may be viewed on recreational-grade GPS devices. Device vendors tend to promote proprietary map data formats and sell data downloads for their particular devices. Therefore, it is not practical for the State to develop functionality that allows recreational users to download the reference map data for their GPS devices in a single standard format from a statewide trails database.

However, standards do exist for GPS route and waypoint data. It is feasible to add functionality to the trails database web access application that allows the user to download routes and waypoints. GPX, or GPS exchange Format, is an XML schema designed for sharing GPS data between software applications and internet web services. It is also useful for sharing GPS data between users.

The conceptual design for GPS data download functionality is defined in terms of the public's user experience. In a typical public user scenario, the user links to the system's website through the state agency website or any participating agency's website. After viewing and identifying a trail of interest, as described above, the user selects a trail or multiple trails for download. Selection tools allow the user to:

- Select one or more trails by number or name

- Select one or more trail segments using feature pointing

- Select all trails within a user-defined rectangle

Users may download limited amounts of data from the website. Downloads are limited to 1 MB in order to minimize their impact on site performance. Users are limited to 3 downloads per session to prevent data mining applications from impacting site performance.

The conceptual design for this estimated cost item assumes that there is no capability provided for downloading reference map data. It assumes that only GPS data may be downloaded.

WEB-BASED PORTAL

A web-based trails information portal will be designed to provide links to existing trail information available on the Internet. Development of the trails portal is independent of the trails database and web access defined in 2.4.1 above. It is a separate and much simpler web site. The portal will be accessed through a link on the managing agency's main web page, as well as through a link on web pages of other government agencies. The sources of trail and facility information may include links to web resources for parks, campgrounds, published maps, state and federal agency trails data in GIS or descriptive format, and any public or private web sites the administrator has chosen to include.

Other organizations have used the portal concept to consolidate links to similar information. The State of Oregon Parks and Recreation Department, for example, maintains a web page (http://www.oregon.gov/OPRD/ATV/index.shtml) that provides access to information about their all terrain vehicle (ATV) program.   This site presents information places to ride ATVs, opportunities for safety training, and links to other related web sites. American Trails, a non-profit organization promoting trail interests, maintains a web site (http://www.americantrails.org) that provides extensive information about trails nation wide. This site allows the user to search for trails and related information by state. South Carolina's State Trails Program has developed a trails portal site (http://sctrails.net/trails/) that provides extensive information about trails in that state, and links to an extensive list of government and non-government trail resources.

Appendix D

APPENDIX D

COST AND SCHEDULE ESTIMATES

This appendix provides sufficiently detailed cost and schedule estimates to allow the State to determine the requirements for funding capital costs. Estimates assume that services are contracted to the extent possible. Agency costs are estimated where staff effort is required, using an assumed total (burdened) hourly rate of $100.

Table D-1 provides estimates for the three major cost items, including a breakdown for the first item. Assumptions for each of the cost items are provided.

Table D-1—Estimated Implementation Costs

Cost Category	Low	High
1. Develop GIS Trails Database with Web Access & GPS Download		
Database Design	$43,000	$43,000
Source Data Provision & Coordination	$231,650	$231,650
Trails Database Collection		
State Lands	$882,020	$1,235,630
Federal Lands	$369,200	$543,800
Data Translation	$20,000	$20,000
Web Access	$95,000	$145,000
2. GPS Data Download Functionality	$72,000	$87,000
Subtotal	**$1,712,870**	**$2,306,080**
3. Web Portal	**$19,000**	**$29,000**
TOTAL	**$1,731,870**	**$2,335,080**

TRAILS DATABASE AND WEB ACCESS

Database

Estimated costs to develop a trails database are divided into four categories:

- Database design and conversion specifications
- Source data provision and coordination
- Data collection/compilation/quality assurance

- Data translation

For simplicity and reliability, estimated costs

Database Design and Conversion Specifications

It is assumed that the agencies that will manage and update the trails data will participate in the database design process at a cost of 40 staff hours per agency. It is also assumed that the design effort is constrained to the scope defined by the conceptual database design presented in Appendix C. Costs to extend the design to address agency-specific data needs are not included in this estimate.

It is assumed that managing agency staff will administer the database design and data conversion specification efforts.

It is assumed that the technical labor for the database design and conversion specification efforts will be contracted.

Table D-2 contains the estimated cost by agency for database design and development of a data conversion specification.

Table D-2 – Estimated Cost of Database Design and Conversion Specification

Agency	Hours	Cost/Hour	Total
IAC	80	$100	$8,000
Contractor	120	$125	$15,000
State Parks	40	$100	$4,000
DNR	40	$100	$4,000
National Park Service	40	$100	$4,000
BLM	40	$100	$4,000
U.S. Forest Service	40	$100	$4,000
TOTAL			**$43,000**

Source Data Provision and Coordination

Significant staff effort will be required of participating agencies to provide initial source data indicating maintained trails, performing quality assurance on trails data that is collected and compiled under contract, and editing the data prior to finalizing the database. Cost per mile to prepare data for use in the trails database are estimated as a function of cost per mile of trail for agency staff effort to retrieve and interpret source data from its managed location, perform quality assurance checks, perform necessary editing and manage project activities. Table D-3 provides the estimated cost of this database cost category.

Table D-3 – Estimated Cost of Source Data Provision and Coordination
(Based on $100 per staff hour)

Agency	Trail Type	Est. Miles	Obtain Source Data (hours/mi)	Quality Assurance (hours/mi)	Edit data (hours/mi)	Project Mgt	Cost/ Mile	Total Cost
				Agency Staff Effort				
State Parks	Hiking	700	0.1	0.1	0.25	0.05	$50	$35,000
	Mountain Bike	20	0.1	0.1	0.25	0.05	$50	$1,000
	Equestrian	38	0.1	0.1	0.25	0.05	$50	$1,900
	Long-Distance:							
	Centennial	37	0.1	0.1	0.25	0.05	$50	$1,850
	John Wayne	100	0.1	0.1	0.25	0.05	$50	$5,000
	Willapa Hills	56	0.1	0.1	0.25	0.05	$50	$2,800
	Columbia Plateau	130	0.1	0.1	0.25	0.05	$50	$6,500
	Subtotal	**1,081**						**$54,050**
DNR	All uses - new mapping	990	0.1	0.1	0.25	0.05	$50	$49,500
	All uses - existing	110	0.1	0.1	0.25	0.05	$50	$5,500
	Subtotal	**1,100**						**$55,000**
State Agencies		**2,181**						**$109,050**
National Park Service	Hiking	1,500	0.1	0.1	0.25	0.05	$50	$75,000
BLM	All uses	1,190	0	0.1	0.25	0.05	$40	$47,600
U.S. Forest Service	Hiking	4,600						$20,000*
	ORV	1,150						$0
Federal Agencies		**8,440**						**$142,600**
TOTAL		**19,331**						**$251,650**

* The U.S. Forest service maintains a significant volume of trails data in its information systems. It is assumed that a data translation utility must be developed to import trails data managed by the U.S. Forest Service. Cost for the translation utility is estimated to be $20,000.

Data Collection / Compilation / Quality Assurance

Based on information included in Appendix B on the availability of existing trails data, Table D-4 was compiled to estimate the cost of additional data collection, compilation, and quality assurance. Construction costs per mile vary, depending on the use of domestic or off-shore labor for the compilation component.

Table D-4 – Estimated Cost of Data Collection / Compilation / Quality Assurance

Agency	Trail Type	Est. Miles	Construction Cost/Mile	Total Cost
State Parks	Hiking	700	$460 – $640	$322,000 – $448,000
	Mountain Bike	20	$460 – $640	$9,200 – $12,800
	Equestrian	38	$460 – $640	$17,480 – $24,320
	Long-Distance:			
	Centennial	37	$180 – $270	$6,660 – $9,990
	John Wayne	100	$180 – $270	$18,000 – $27,000
	Willapa Hills	56	$180 – $270	$10,080 – $15,120
	Columbia Plateau	130	$180 – $270	$23,400 – $35,100
	Subtotal	**1,081**		**$406,820 – $572,330**
DNR	All uses - new mapping	990	$460 – $640	$455,400 – $633,600
	All uses - existing	110	$180 – $270	$19,800 – $29,700
	Subtotal	**1,100**		**$475,200 – $663,300**
State Agencies		**2,181**		**$882,020 – $1,235,630**
National Park Service	Hiking	1,500	$90 – $135	$135,000 – $202,500
BLM	All uses	1,190	$180 – $270	$214,200 - $321,300
U.S. Forest Service	Hiking	4,600	0	$0
	ORV	1,150	0	$0
Federal Agencies		**7,250**		**$349,200 – $543,800**
TOTAL		**9,431**		**$1,231,220 – $1,759,430**

Significant trails data exist for the U.S. Forest Service lands, including features and attributes. It is assumed that there is no additional cost for data collection, compilation, or quality assurance.

Trail feature data (GIS map data) exist for the National Park Service lands but attribute data must be compiled. Therefore, trail features must be attributed.

Washington DNR maintains an estimated 1,100 miles of designated trails, comprised of a combination of use designations. Approximately ten percent of these trails are mapped.

Washington State Parks has mapped trails only on a pilot basis. It is assumed that all state park trails need to be mapped and attributed.

Web Access

Costs for web access application development are based on an estimate of 100 function points. Costs per function point range from $750 to $1,250. The contracted application development cost is $75,000 to $125,000. The cost of contract administration, quality assurance, and transition is 200 hours of staff time at $100 per hour, or $20,000.

GPS Data Download Functionality

Costs for web portal development are based on an estimate of 60 function points. Costs per function point range from $750 to $1,250. The contracted application development cost is $60,000 to $75,000. The cost of contract administration, quality assurance, and transition is 120 hours of staff time at $100 per hour, or $12,000.

Web Portal

Costs for web portal development are based on an estimate of 20 function points. Costs per function point range from $750 to $1,250. The contracted application development cost is $15,000 to $25,000. The cost of contract administration, quality assurance, and transition is 40 hours of staff time at $100 per hour, or $4,000.

SCHEDULE

Figure D-1 provides the recommended schedule for implementing the trails database with web access and optional GPS data download functionality. Application development should start immediately upon project authorization. Data conversion should start after database design is completed (at the end of the elaboration phase). The application construction schedule will vary by up to two months, depending on whether the GPS data download functionality is included. The entire project should be scheduled for two years. The site should launch with State Parks data. DNR, U.S. Forest Service, and National Parks data should be added in whole management units as they are completed.

The web portal development should be scheduled for two to three months, including transition. Transition is the phase during which the product is moved from the development organization to the end user. The activities of this phase include training of the end users and maintainers and testing of the system to validate it against the end users' expectations.

Figure D-1—Schedule for Trails Database & Web Portal

Task Name	er	1st Quarter			2nd Quarter			3rd Quarter			4th Quarter			1st Quarter			2nd Quarter			3rd Quarter			4th Quarter		
	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
– Database Design, Web Interface, GPS Download																									
Elaboration																									
Construction																									
Transition																									
– Data Development																									
State Parks																									
DNR																									
U.S. Forest Service Translator																									
National Parks																									
– Web Portal																									
Elaboration																									
Construction																									
Transition																									